

New Hampshire Volunteer River Assessment Program 2005 Contoocook River Water Quality Report



Photo: Contoocook River (30M-CTC), Sharon Road Bridge, Peterborough

Prepared by:

State of New Hampshire
Department of Environmental Services
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**New Hampshire Volunteer River Assessment Program
2005 Contoocook River Water Quality Report**

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ACKNOWLEDGEMENTS

The New Hampshire Department of Environmental Services (NHDES) -Volunteer River Assessment Program (VRAP) extends sincere thanks to the volunteers of the Contoocook North Branch Rivers Local Advisory Committee (CNBRLAC) for their efforts during 2005. This report was created solely from the data collected by the volunteers listed below. Their time and dedication is an expression of their genuine concern for local water resources and has significantly contributed to our knowledge of river and stream water quality in New Hampshire.

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1. INTRODUCTION

1.1. Purpose of Report

Each year the VRAP prepares and distributes a water quality report for each volunteer group that is based solely on the water quality data collected by that volunteer group during a specific year. The reports summarize and interpret the data, particularly as they relate to New Hampshire surface water quality standards, and serve as a teaching tool and guidance document for future monitoring activities by the individual volunteer groups.

1.2. Report Format

Each report includes the following:

❖ **Volunteer River Assessment Program (VRAP) Overview**

This section includes a discussion of the history of VRAP, the technical support, training and guidance provided by NHDES, and how data is transmitted to the volunteers and used in surface water quality assessments.

❖ **Monitoring Program Description**

This section provides a description of the volunteer group's monitoring program including monitoring objectives as well as a table and map showing sample station locations.

❖ **Results and Discussion**

Water quality data collected during the year are summarized on a parameter-by-parameter basis using (1) a summary table that includes the number of samples collected, data ranges, the number of samples meeting New Hampshire water quality standards, and the number of samples adequate for water quality assessments at each station, (2) a discussion of the data, (3) a list of applicable recommendations, and (4) a river graph showing the range of measured values at each station. Sample results reported as less than the detection limit were assumed equal to one-half the detection limit on the river graphs. This approach simplifies the understanding of the parameter of interest, and specifically helps one to visualize how the river or watershed is functioning from upstream to downstream. In addition, this format allows the reader to better understand potential pollution areas and target those areas for additional sampling or environmental enhancements. Where applicable, the river graph also shows New Hampshire surface water quality standards or levels of concern for comparison purposes.

❖ **Appendix A – Data**

This appendix includes a spreadsheet showing the data results and additional information, such data results which do not meet New Hampshire surface water quality standards, and data that is unusable for assessment purposes due to quality control requirements.

❖ **Appendix B – Interpreting VRAP Water Quality Parameters**

This appendix includes a brief description of water quality parameters typically sampled by VRAP volunteers and their importance, as well as applicable state water quality criteria or levels of concern.

❖ **Appendix C – Glossary of River Ecology Terms**

This appendix contains a list of terms commonly used when discussing river ecology and water quality.

2. PROGRAM OVERVIEW

2.1. Past, Present, and Future

In 1998, the New Hampshire Department of Environmental Services (NHDES) initiated the New Hampshire Volunteer River Assessment Program (VRAP) as a means of expanding public education of water resources in New Hampshire. VRAP promotes awareness and education of the importance of maintaining water quality in rivers and streams. VRAP was created in the wake of the success of the existing New Hampshire Volunteer Lake Assessment Program (VLAP), which provides educational and stewardship opportunities pertaining to lakes and ponds to New Hampshire's residents.

Today, VRAP continues to serve the public by providing water quality monitoring equipment, technical support, and educational programs. In 2005, VRAP supported twenty-eight volunteer groups on numerous rivers and watersheds throughout the state. These volunteer groups conduct water quality monitoring on an ongoing basis. The work of the VRAP volunteers increases the amount of river water quality information available to local, state and federal governments, which allows for effective financial resource allocation and watershed planning.

2.2. Technical Support

VRAP lends and maintains water quality monitoring kits for volunteer groups throughout the state. The kits contain electronic meters and supplies for "in-the-field" measurements of water temperature, dissolved oxygen, pH, specific conductance (conductivity), and turbidity. These are the core parameters typically measured by volunteers. However, other water quality parameters such as nutrients, metals, and *E. coli* can also be studied by volunteer groups, although VRAP does not always provide funds to cover laboratory analysis costs. Thus, VRAP encourages volunteer groups to pursue other fundraising activities such as association membership fees, special events, in-kind services (non-monetary contributions from individuals and organizations), and grant writing.

VRAP typically recommends sampling every other week during the summer, and volunteer groups are encouraged to organize a long-term sampling program in order to begin to determine trends in river conditions. Each year volunteers design and arrange a sampling schedule in cooperation with NHDES staff. Project designs are created through a review and discussion of existing water quality information, such as known and perceived problem areas or locations of exceptional water quality. The interests, priorities, and resources of the partnership determine monitoring locations, parameters, and frequency.

Water quality measurements repeated over time create a picture of the fluctuating conditions in rivers and streams and help to determine where improvements, restoration or preservation may benefit the river and the communities it supports. Water quality results are also used to determine if a

river is meeting surface water quality standards. Volunteer monitoring results, meeting DES Quality Assurance and Quality Control (QA/QC) requirements, supplement the efforts of DES to assess the condition of New Hampshire surface waters. The New Hampshire Surface Water Quality Regulations are available through the DES Public Information Center at www.des.state.nh.us/wmb/Env-Ws1700.pdf or (603) 271-1975.

2.3. Training and Guidance

Each VRAP volunteer attends an annual training session to receive a demonstration of monitoring protocols and sampling techniques. Training sessions are an opportunity for volunteers to receive an updated version of monitoring techniques. During the training, volunteers have an opportunity for hand-on use of the VRAP equipment and may also receive instruction in the collection of samples for laboratory analysis. Training is accomplished in approximately two hours, after which volunteers are certified in the care, calibration, and use of the VRAP equipment. In some cases, veteran group coordinators can attend a “train the trainer” session. In these trainings the group coordinator receives an update in sampling protocols and techniques and will then train the individual volunteers of their respective group.

VRAP groups conduct sampling according to a prearranged monitoring schedule and VRAP protocols. NHDES staff from the VRAP program aim to visit each group annually during a scheduled sampling events to verify that volunteers successfully follow the VRAP protocols. If necessary, volunteers are re-trained during the visit, and the group’s monitoring coordinator is notified of the result of the verification visit. VRAP groups forward water quality results to NHDES for incorporation into an annual report and state water quality assessment activities.

2.4. Data Usage

2.4.1. Annual Water Quality Reports

All data collected by volunteers are summarized in water quality reports that are prepared and distributed after the conclusion of the sampling period (typically fall or winter). Each volunteer group receives copies of the report. The volunteers can use the reports and data as a means of understanding the details of water quality, guiding future sampling efforts, or determining restoration activities.

2.4.2. New Hampshire Surface Water Quality Assessments

Along with data collected from other water quality programs, specifically the State Ambient River Monitoring Program, applicable volunteer data are used to support periodic DES surface water quality assessments. VRAP data are entered into NHDES’s Environmental Monitoring Database and are ultimately uploaded to the Environmental Protection Agency’s database, STORET.

Assessment results and the methodology used to assess surface waters are published by DES every two years (i.e., Section 305(b) Water Quality Reports) as required by the federal Clean Water Act. The reader is encouraged to log on to the DES web page to review the assessment methodology and list of impaired waters <http://www.des.state.nh.us/wmb/swqa/>.

2.5. Quality Assurance/Quality Control

In order for VRAP data to be used in the assessment of New Hampshire's surface waters, the data must meet quality control guidelines as outlined in the VRAP Quality Assurance Project Plan (QAPP). The VRAP QAPP was approved by NHDES and reviewed by EPA in the summer of 2003. The QAPP is reviewed annually and is officially updated and approved every five years. The VRAP Quality Assurance/Quality Control (QA/QC) measures include a six-step approach to ensuring the accuracy of the equipment and consistency in sampling efforts.

- ❖ **Calibration:** Prior to each measurement, the pH and dissolved oxygen meters are calibrated. Conductivity and turbidity meters are calibrated and/or checked against a known standard before the first measurement and after the last one.
- ❖ **Replicate Analysis:** A second measurement by each meter is taken from the original sample at one of the stations during the sampling day. The replicate analysis should not be conducted at the same station over and over again, but should be conducted at different stations throughout the monitoring season.
- ❖ **6.0 pH Standard:** A reading of the pH 6.0 buffer is recorded at one of the stations during the sampling day. If the same sampling schedule is used throughout the monitoring season, the 6.0 pH standard check should be conducted at different stations.
- ❖ **Zero Oxygen Standard:** A reading of a zero oxygen solution is recorded at one of the stations during the sampling day. If the same sampling schedule is used throughout the monitoring season, the zero oxygen standard check should be conducted at different stations.
- ❖ **DI Turbidity Blank:** A reading of the DI blank is recorded at one of the stations during the sampling day. If the same sampling schedule is used throughout the monitoring season, the blank check should be conducted at different stations.
- ❖ **Post-Calibration:** At the conclusion of each sampling day, all meters are calibrated.

2.5.1. Measurement Performance Criteria

Precision is calculated for field and laboratory measurements through measurement replicates (instrumental variability) and is calculated for each sampling day. The use of VRAP data for assessment purposes is contingent on compliance with a parameter-specific relative percent difference (RPD) as derived from equation 1, below. Any data exceeding the limits of the individual measures are disqualified from surface water quality assessments. All data that exceeds the limits defined by the VRAP QAPP are acknowledged in the data tables with an explanation of why the data was unusable. Table 1 shows typical parameters studied under VRAP and the associated quality control procedures.

(Equation 1)

$$RPD = \frac{|x_1 - x_2|}{\frac{x_1 + x_2}{2}} \times 100 \%$$

where x_1 is the original sample and x_2 is the replicate sample

Table 1. Field Analytical Quality Controls

Water Quality Parameter	QC Check	QC Acceptance Limit	Corrective Action	Person Responsible for Corrective Action	Data Quality Indicator
Temperature	Measurement replicate	± 0.2 °C	Repeat measurement	Volunteer Monitors	Precision
Dissolved Oxygen	Measurement replicate	± 2% of saturation, or ± 0.2 mg/L	Recalibrate instrument, repeat measurement	Volunteer Monitors	Precision
	Known buffer (zero O ₂ solution)	<0.5 mg/L	Recalibrate instrument, repeat measurement	Volunteer Monitors	Relative accuracy
pH	Measurement replicate	± 0.1 std units	Recalibrate instrument, repeat measurement	Volunteer Monitors	Precision
	Known buffer (pH = 6.0)	± 0.1 standard units	Recalibrate instrument repeat measurement	Volunteer Monitors	Accuracy
Specific Conductance	Measurement replicate	± 30 µS/cm	Recalibrate instrument, repeat measurement	Volunteer Monitors	Precision
	Method blank (Zero air reading)	± 5.0 µS/cm	Recalibrate instrument, repeat measurement	Volunteer Monitors	Accuracy
Turbidity	Measurement replicate	± 0.1 NTU	Recalibrate instrument, repeat measurement	Volunteer Monitors	Precision
	Method blank (DI Water)	± 0.1 NTU	Recalibrate instrument, repeat measurement	Volunteer Monitors	Accuracy

3. METHODS

During the summer of 2005, volunteers from the Contoocook North Branch Rivers Local Advisory Committee began water quality monitoring on the Contoocook River and the North Branch Contoocook River. The goal of this effort was to provide water quality data from the Contoocook River watershed relative to surface water quality standards and to allow for the assessment of the rivers for support of aquatic life. The establishment of a long-term monitoring program will allow for an understanding of the river's dynamics, or variations on a station-by-station and year-to-year basis. The data can also serve as a baseline from which to determine any water pollution problems in the river and/or watershed. The Volunteer River Assessment Program has provided field training, equipment, and technical assistance.

During 2005, trained volunteers from the Contoocook North Branch Rivers Local Advisory Committee monitored water quality at ten stations along the mainstem of the Contoocook River from Jaffrey to Penacook. One station was monitored on the North Branch in Hillsborough (Figure 1, Table 2). Four additional stations along the mainstem of the Contoocook River were monitored by NHDES using submersible dataloggers.

Station IDs are designated using a three letter code to identify the waterbody name plus a number indicating the relative position of the station. The higher the station number the more upstream the station is in the watershed. The mainstems of the Contoocook and North Branch Rivers are designated as Class B waters.

Water quality monitoring was conducted from June to September. In-situ measurements of water temperature, air temperature, dissolved oxygen, pH, turbidity and specific conductance were taken using handheld meters provided by NHDES. Table 3 summarizes the parameters measured, laboratory standard methods, and equipment used.

Table 2. Sampling Stations for the Contoocook River, NHDES VRAP, 2005

Station ID	Location	Town	Elevation*(Ft.)
37-CTC	Contoocook Lake Dam/Red Dam	Jaffrey	1000
35-CTC	Nutting Road Bridge	Jaffrey	1000
34-CTC	DD Bean Factory Footbridge	Jaffrey	1000
32M-CTC	Upstream of Jaffrey WWTF Outfall	Jaffrey	900
30-CTC	Noone Falls Dam	Peterborough	700
27-CTC	Upstream of North Village Dam	Peterborough	700
26-CTC	Route 202/136 Bridge	Peterborough	700
25-CTC	County Bridge	Hancock	700
22-CTC	Depot Street Bridge	Bennington	600
01-NBC	North Branch Contoocook Stone Arch Bridge	Hillsborough	600
17-CTC	Grimes Field Boat Launch	Hillsborough	600
16-CTC	Contoocook Falls Road Bridge	Hillsborough	600
03-CTC	Route 3 Bridge	Penacook	300
02-CTC	East Street Bridge	Penacook	300

*Elevations have been rounded off to 100-foot increments for calibration of dissolved oxygen meter

Figure 1. Contoocook River Watershed and Monitoring Stations 2005



Table 3. Sampling and Analysis Methods

Parameter	Sample Type	Standard Method	Equipment Used	Laboratory
Temperature	In-Situ	SM 2550	YSI 95	-----
	Datalogger	SM 2550	YSI XLM 6000	-----
Dissolved Oxygen	In-Situ	SM 4500 O G	YSI 95	-----
	Datalogger	SM 4500 O G	YSI XLM 6000	-----
pH	In-Situ	SM 4500 H+	Orion 210A+	-----
	Datalogger	SM 4500 H+	YSI XLM 6000	-----
Turbidity	In-Situ	EPA 180.1	Lamotte 2020	-----
Specific Conductance	In-Situ	SM 2510	YSI 30	-----
	Datalogger	SM 2510	YSI XLM 6000	-----

4. RESULTS AND DISCUSSION

4.1. Dissolved Oxygen

Between five and eight measurements were taken in the field for dissolved oxygen concentration at 11 stations on the mainstem of the Contoocook and North Branch Rivers from Jaffrey to Penacook. (Table 4). Of the 76 measurements taken, 74 met quality assurance/quality control (QA/QC) requirements and are usable for New Hampshire's 2006 surface water quality report to the Environmental Protection Agency. VRAP staff also deployed submersible dataloggers (described below) to record dissolved oxygen at four stations on the mainstem of the Contoocook River.

The Class B New Hampshire surface water quality standard for dissolved oxygen includes a minimum concentration of 5.0 mg/L **and** a minimum daily average of 75 % of saturation. In other words, there are criteria for both concentration and saturation that must be met before the river can be assessed as meeting dissolved oxygen standards. Table 4 reports only dissolved oxygen concentration as more detailed analysis is required to determine if instantaneous dissolved oxygen saturation measurements are above or below water quality standards.

Table 4. Dissolved Oxygen (mg/L) Data Summary - Contoocook River, 2005

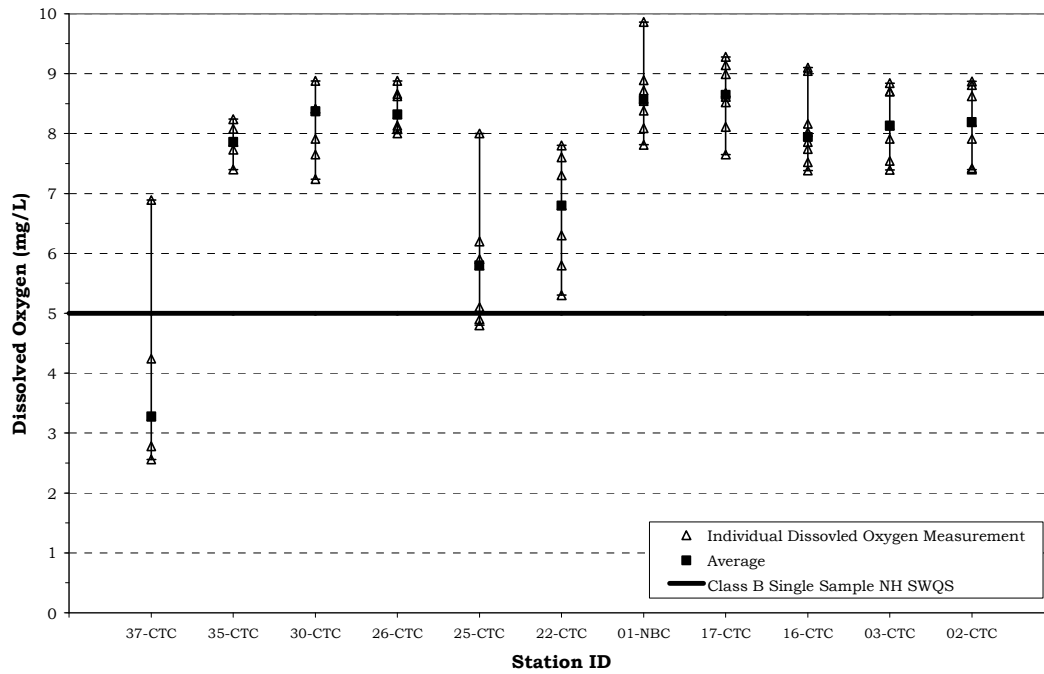
Station ID	Samples Collected	Data Range (mg/l)	Acceptable Samples Not Meeting NH Class B Standards	Number of Usable Samples for 2006 NH Surface Water Quality Assessment
37-CTC	5	2.56 - 6.89	3	4 ^a
35-CTC	5	7.40 - 8.24	0	4 ^a
30-CTC	7	7.24 - 8.88	0	7
26-CTC	7	8.00 - 8.88	0	7
25-CTC	7	4.80 - 8.00	2	7
22-CTC	7	5.30 - 7.80	0	7
01-NBC	8	7.81 - 9.86	0	8
17-CTC	8	7.65 - 9.28	0	8
16-CTC	8	7.38 - 9.10	0	8
03-CTC	7	7.39 - 8.84	0	7
02-CTC	7	7.40 - 8.87	0	7
Total Number of Useable Samples for 2006 NH Surface Water Quality Assessment				74

^a Relative % difference of replicate exceeded standard in QAPP 06/11/05

Dissolved oxygen concentration levels were variable with the average ranging from 3.3 mg/L to 8.6 mg/L (Figure 2). Stations 37-CTC and 25-CTC had dissolved oxygen levels that were below state standards on multiple occasions. All other stations had dissolved oxygen levels above the standard on all occasions. Levels of dissolved oxygen sustained above the standards are considered adequate for the support of aquatic life and other desirable water quality conditions. Stations where the instantaneous dissolved oxygen

standard was not met could potentially have a dissolved oxygen problem and further investigation is warranted.

**Figure 2. Dissolved Oxygen Statistics for the Contoocook River
June 8 - September 20, 2005, NHDES VRAP**



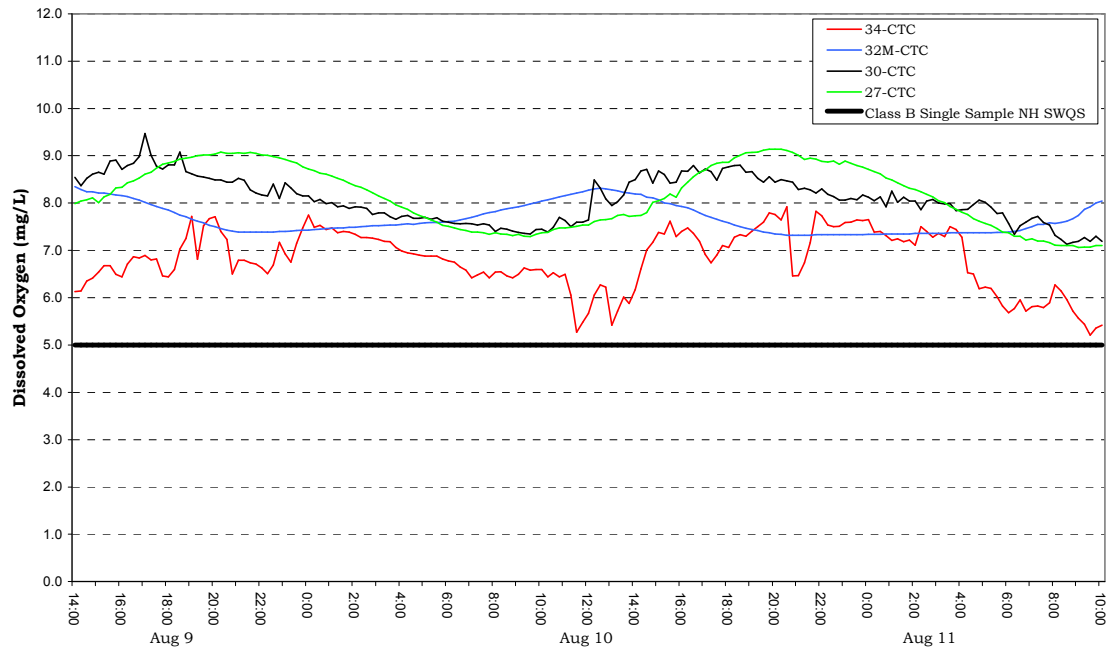
Figures 3 and 4 show the results of dissolved oxygen concentration and saturation levels obtained at four stations on the mainstem of the Contoocook River using submersible dataloggers. The meters were programmed to take dissolved oxygen readings every 15 minutes. Data from these meters is generally analyzed in 24 hour sections. During this deployment one full 24-hour period was measured. The daily average of dissolved oxygen % saturation was above the Class B standard of 75% at all four stations.

Figures 3 and 4 depict the typical cyclical variations in dissolved oxygen measurements one would expect to see during a 24-hour period in the summer. In general, dissolved oxygen levels are lowest in the early morning when there is low photosynthetic activity and a peak in respiration from organisms throughout the water column. This is the time of least oxygen production and greatest carbon dioxide emission. Peak dissolved oxygen levels occur when photosynthetic activity is at its peak. The greater the amount of photosynthetic activity the greater the production of oxygen as a byproduct of photosynthesis.

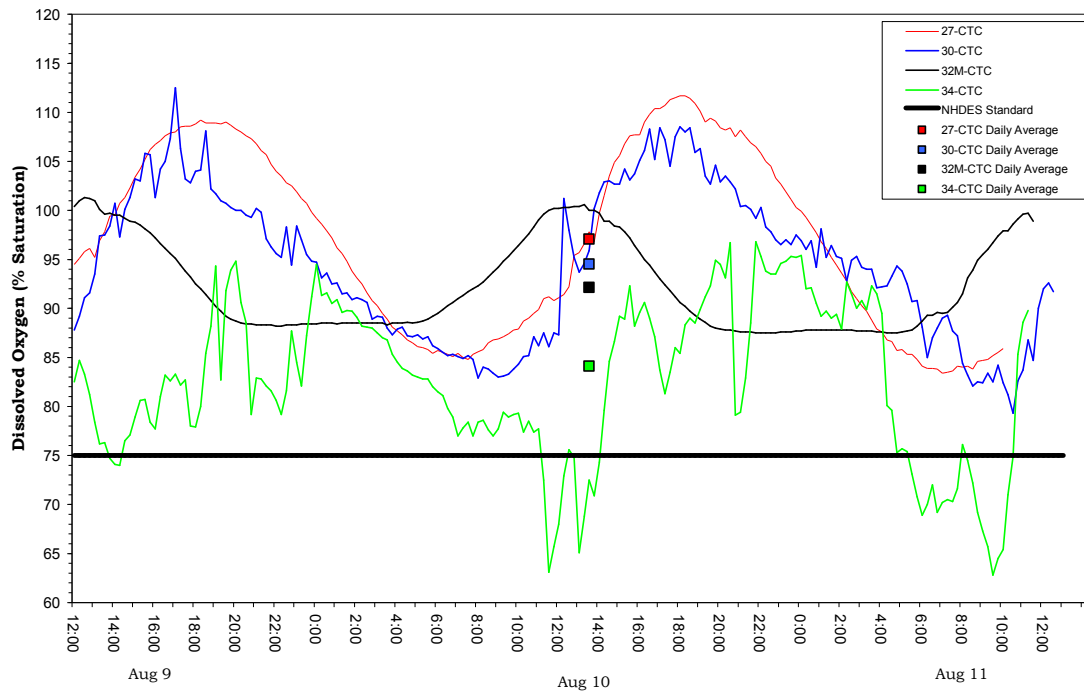
During 2002 and 2004, NHDES initiated a water quality sampling program to support the development of a total maximum daily load (TMDL) for the Contoocook River. In 2002 the study focused on the Peterborough area and in 2004 in Jaffrey. This work is focused primarily on dissolved oxygen and nutrient levels. The sampling stations that were established to support the TMDL coincide with the ones currently monitored by the Contoocook North

Branch Rivers Local Advisory Committee. Continued monitoring of dissolved oxygen will benefit the public and NHDES by providing data before and after implementation of the TMDL. The datalogger data collected this year will be particularly helpful to the Contoocook River TMDLs.

**Figure 3. Dissolved Oxygen Concentration Statistics for the Contoocook River
August 9-11, 2005, NHDES VRAP**



**Figure 4. Dissolved Oxygen Saturation Statistics for the Contoocook River
August 9-11, 2005, NHDES VRAP**



Recommendations

- ❖ Continue sampling at all stations in order to develop a long-term data set to better understand trends as time goes on.
- ❖ If possible, take measurements between 5:00 a.m. and 10:00 a.m., which is when dissolved oxygen is usually the lowest, and between 2:00 p.m. and 7:00 p.m. when dissolved oxygen is usually the highest. In general, dissolved oxygen levels are lowest in the early morning when there is low photosynthetic activity and a peak in respiration from organisms throughout the water column.
- ❖ Continue to incorporate the use of in-situ dataloggers to automatically record dissolved oxygen saturation levels during a period of several days. The use of these instruments is dependent upon availability, and requires coordination with NHDES.

4.2. pH

Between five and seven measurements were taken in the field for pH at 11 stations on the mainstem of the Contoocook and North Branch Rivers from Jaffrey to Penacook. [Table 5]. Of the 72 measurements taken, all met quality assurance/quality control (QA/QC) requirements and are usable for New Hampshire's 2006 surface water quality report to the Environmental Protection Agency. The Class B New Hampshire surface water quality standard is 6.5 - 8.0, unless naturally occurring. VRAP staff also deployed submersible dataloggers to record pH at four stations on the mainstem of the Contoocook River.

Table 5. pH Data Summary - Contoocook River, 2005

Station ID	Samples Collected	Data Range (standard units)	Acceptable Samples Not Meeting NH Class B Standards	Number of Usable Samples for 2006 NH Surface Water Quality Assessment
37-CTC	5	5.01 - 5.69	4	5
35-CTC	5	5.61 - 6.15	5	5
30-CTC	7	5.69 - 6.43	7	7
26-CTC	6	5.73 - 6.71	4	6
25-CTC	7	6.74 - 6.93	0	7
22-CTC	7	6.70 - 7.01	0	7
01-NBC	7	5.91 - 6.60	5	7
17-CTC	7	6.01 - 6.72	3	7
16-CTC	7	5.87 - 6.69	5	7
03-CTC	7	6.47 - 6.97	1	7
02-CTC	7	6.20 - 6.99	4	7
Total Number of Useable Samples for 2006 NH Surface Water Quality Assessment				72

A majority of stations had pH measurements that were below the New Hampshire surface water quality standard (Figure 3). Stations 25-CTC and 22-CTC were within the pH standard on all occasions.

Lower pH measurements are likely the result of natural conditions such as the soils, geology, or the presence of wetlands in the area. Rain and snow falling in New Hampshire is relatively acidic, which can also affect pH levels; after the spring melt or significant rain events, surface waters will generally have a lower pH.

**Figure 5. pH Statistics for the Contoocook River
June 8 - September 20, 2005, NHDES VRAP**

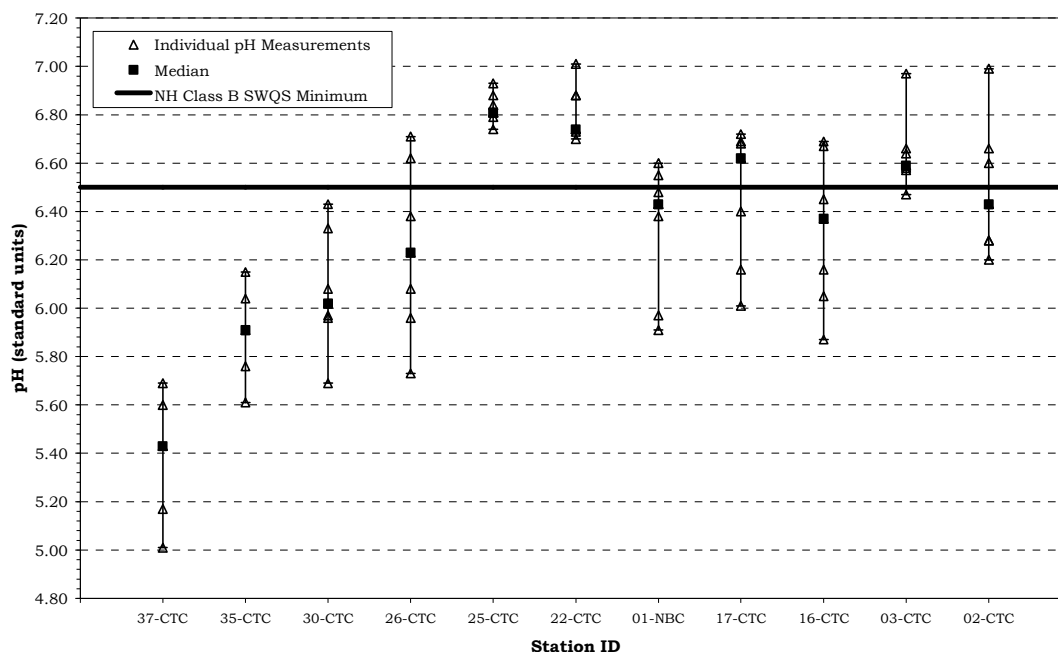
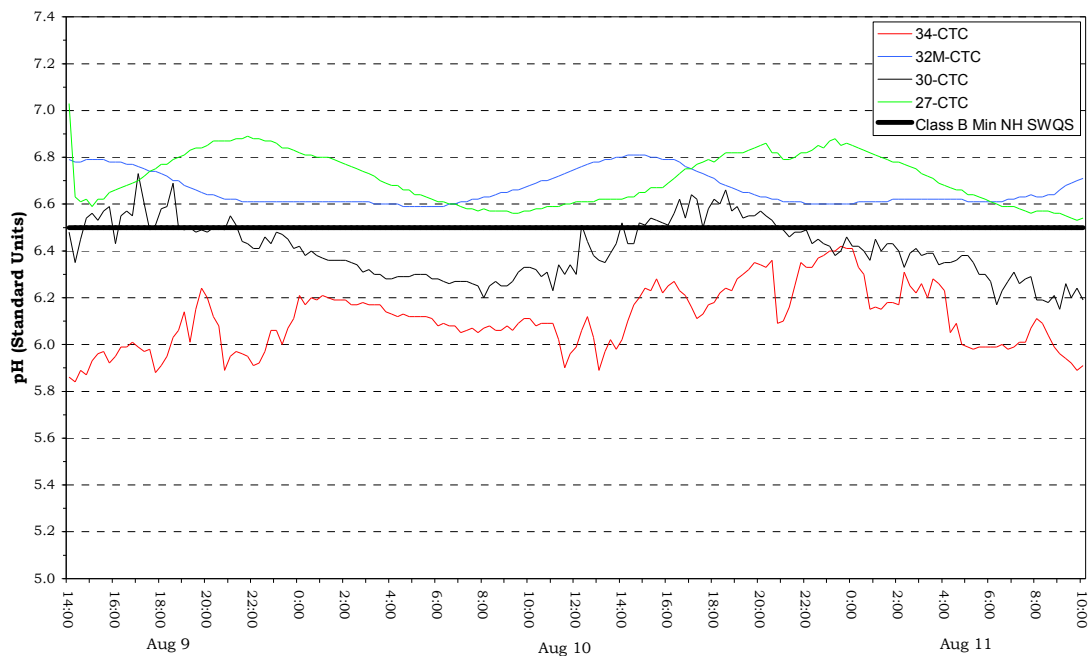


Figure 5 illustrates the results of pH measurements obtained at four stations on the mainstem of the Contoocook River using submersible dataloggers. The meters were programmed to take pH readings every 15 minutes over a three-day period. During this deployment one full 24-hour period was measured. In general the daily minimum pH is used to determine if the waterbodies are meeting surface water quality standards.

The pH readings at 32M-CTC and 27-CTC were within the water quality standard on all occasions during the period of time data was collected. Stations 34-CTC and 30-CTC had pH daily minimums below surface water quality standards.

**Figure 6. pH Statistics for the Contoocook River
August 9-11, 2005, NHDES VRAP**



Recommendations

- ❖ Continue sampling at all stations in order to develop a long-term data set to better understand trends as time goes on.
- ❖ Consider sampling for pH in some of the tributaries and wetland areas that are influencing the pH of stations with measurements below state standards. Site conditions are considered along with pH measurements because of the narrative portion of the pH standard. RSA 485-A:8 states that pH of Class B waters *shall be between 6.5 and 8.0, except when due to natural causes*. Wetlands can lower the pH of a river naturally by releasing tannic and humic acids from decaying plant material. If the sampling location is influenced by wetlands or other natural conditions, then the low pH measurements are not considered a violation of water quality standards. It is important to note that the New Hampshire water quality standard for pH is fairly conservative, thus pH levels slightly below the standard are not necessarily harmful to aquatic life. In this case, additional information about factors influencing pH levels is needed.

4.3. Turbidity

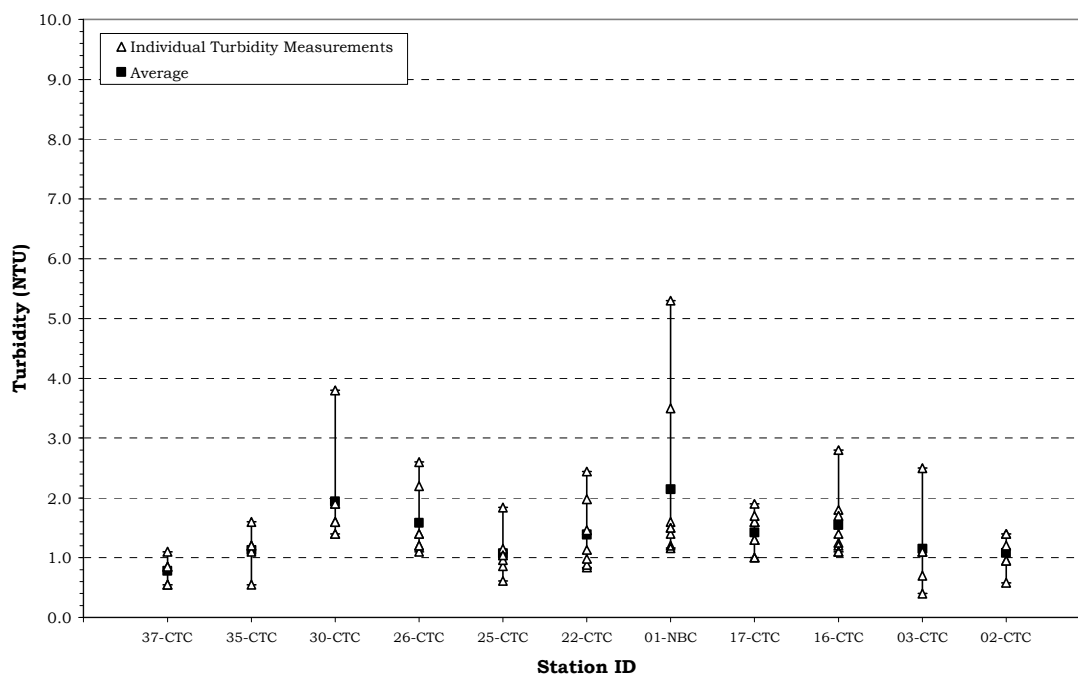
Between five and eight measurements were taken in the field for turbidity at 11 stations on the mainstem of the Contoocook and North Branch Rivers from Jaffrey to Penacook. [Table 6]. Of the 74 measurements taken, all met quality assurance/quality control (QA/QC) requirements and are usable for New Hampshire's 2006 surface water quality report to the Environmental Protection Agency. The Class B New Hampshire surface water quality standard for turbidity is less than 10 NTU above background.

Table 6. Turbidity Data Summary - Contoocook River, 2005

Station ID	Samples Collected	Data Range (NTU)	Acceptable Samples Not Meeting NH Class B Standards	Number of Usable Samples for 2006 NH Surface Water Quality Assessment
37-CTC	5	0.55 - 1.10	0	5
35-CTC	5	0.55 - 1.60	0	5
30-CTC	7	1.40 - 3.80	0	7
26-CTC	7	1.10 - 2.60	0	7
25-CTC	7	0.61 - 1.84	0	7
22-CTC	7	0.84 - 2.44	0	7
01-NBC	8	1.16 - 5.30	0	8
17-CTC	8	1.00 - 1.90	0	8
16-CTC	8	1.10 - 2.80	0	8
03-CTC	6	0.40 - 2.50	0	6
02-CTC	6	0.58 - 1.40	0	6
Total Number of Useable Samples for 2006 NH Surface Water Quality Assessment				74

Turbidity levels were low on all occasions and at all stations with the average ranging from 0.8 NTU to 2.1 NTU (Figure 7). Although clean waters are associated with low turbidity there is a high degree of natural variability involved. Precipitation often contributes to increased turbidity by flushing sediment, organic matter and other materials from the surrounding landscape into surface waters. However, human activities such as removal of vegetation near surface waters and disruption of nearby soils can lead to dramatic increases in turbidity levels. In general it is typical to see a rise in turbidity in more developed areas due to increased runoff.

**Figure 7. Turbidity Statistics for the Contoocook River
June 8 - September 20, 2005, NHDES VRAP**



Recommendations

- ❖ Continue sampling at all stations in order to develop a long-term data set to better understand trends as time goes on.
- ❖ Collect samples during wet weather. This will help us to understand how the river responds to runoff and sedimentation.
- ❖ If a higher than normal turbidity measurement occurs, volunteers can investigate further by moving upstream and taking additional measurements. This will facilitate isolating the location of the cause of the elevated turbidity levels. In addition, take good field notes and photographs. If human activity is suspected or verified as the source of elevated turbidity levels volunteers should contact NHDES.

4.4. Specific Conductance

Between five and eight measurements were taken in the field for specific conductance at 11 stations on the mainstem of the Contoocook and North Branch Rivers from Jaffrey to Penacook [Table 7]. Of the 76 measurements taken, all met quality assurance/quality control (QA/QC) requirements and are usable for New Hampshire's 2006 surface water quality report to the Environmental Protection Agency. New Hampshire surface water quality standards do not contain numeric limits for specific conductance. VRAP staff also deployed submersible dataloggers to record specific conductance at four stations on the mainstem of the Contoocook River.

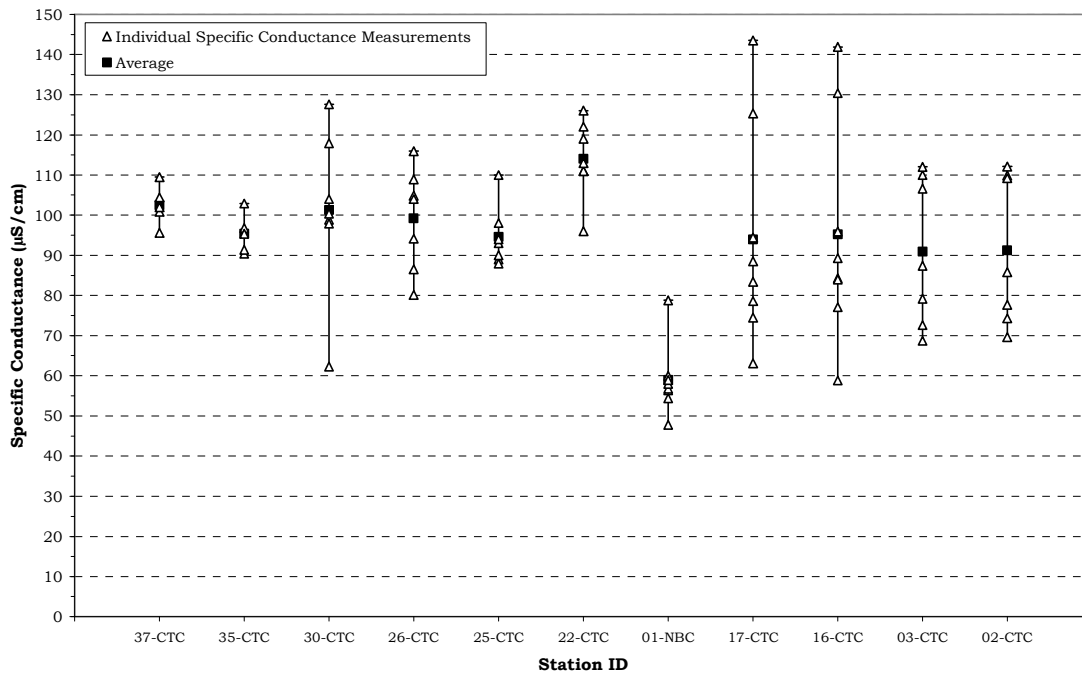
Table 7. Specific Conductance Data Summary - Contoocook River, 2005

Station ID	Samples Collected	Data Range ($\mu\text{S}/\text{cm}$)	Acceptable Samples Not Meeting NH Class B Standards	Number of Usable Samples for 2006 NH Surface Water Quality Assessment
37-CTC	5	95.6 - 109.5	Not Applicable	5
35-CTC	5	90.4 - 102.9	N/A	5
30-CTC	7	62.3 - 127.6	N/A	7
26-CTC	7	80.1 - 115.9	N/A	7
25-CTC	7	90.0 - 110.0	N/A	7
22-CTC	7	96.0 - 126.0	N/A	7
01-NBC	8	47.8 - 78.8	N/A	8
17-CTC	8	63.1 - 143.5	N/A	8
16-CTC	8	58.8 - 141.9	N/A	8
03-CTC	7	68.7 - 112.0	N/A	7
02-CTC	7	69.6 - 112.1	N/A	7
Total Number of Useable Samples for 2006 NH Surface Water Quality Assessment				76

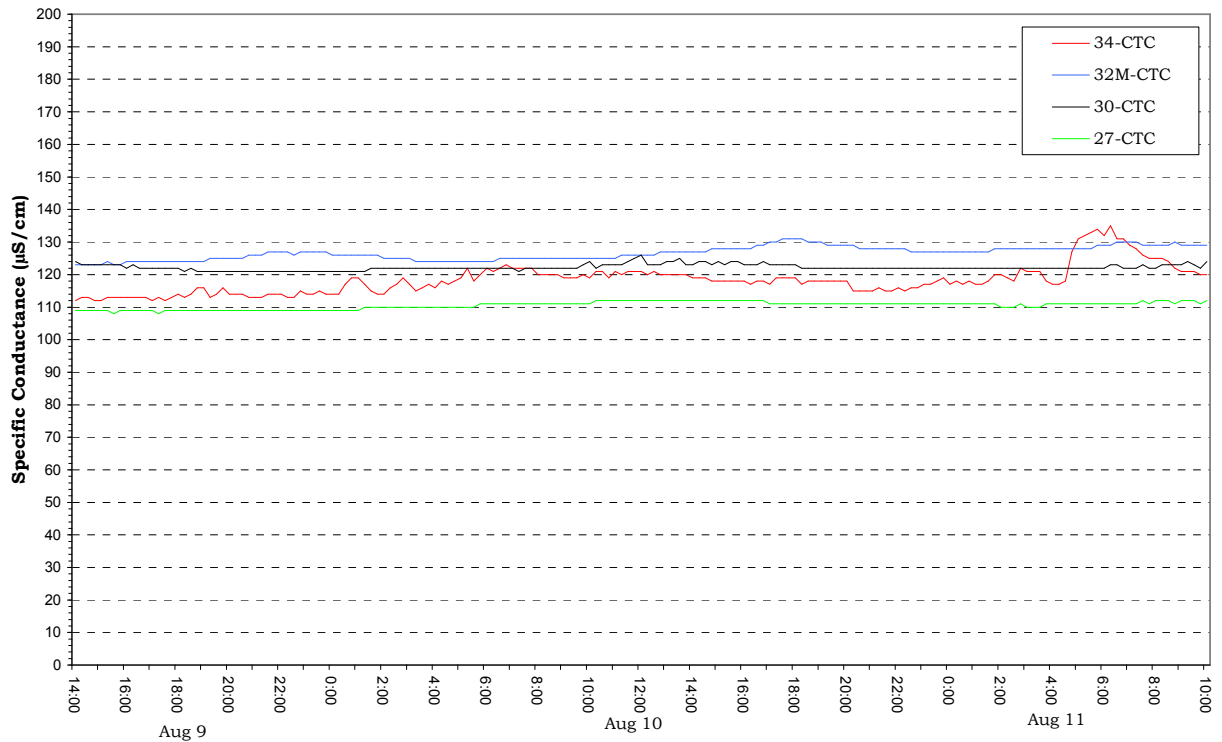
Specific conductance levels were consistent along the entire mainstem of the Contoocook River with the average ranging from 91 $\mu\text{S}/\text{cm}$ to 114 $\mu\text{S}/\text{cm}$ (Figure 8). The average specific conductance was lower, 59 $\mu\text{S}/\text{cm}$ at the stations monitoring on the North Branch. The specific conductance levels at all stations and on all occasions were relatively low. Higher specific conductance levels can be indicative of pollution from sources such as urban/agricultural runoff, road salt, failed septic systems, or groundwater pollution. Thus, the lower specific conductance levels in the Contoocook River generally indicate low pollutant levels.

Figure 9 illustrates the results of specific conductance measurements obtained at four stations on the mainstem of the Contoocook River using submersible dataloggers. The meters were programmed to take specific conductance readings every 15 minutes. At all stations specific conductance levels were relatively low and consistent with the instantaneous measurements taken throughout 2005.

**Figure 8. Specific Conductance Statistics for the Contoocook River
June 8 - September 20, 2005, NHDES VRAP**



**Figure 9. Specific Conductance Statistics for the Contoocook River
August 9-11, 2005, NHDES VRAP**



Recommendations

- ❖ Continue sampling at all stations in order to develop a long-term data set to better understand trends as time goes on.
- ❖ Consider collecting chloride samples at the same time specific conductance is measured. During the late winter/early spring snowmelt, higher conductivity levels are often seen due to elevated concentrations of chloride in the runoff. Conductivity levels are very closely correlated to chloride levels. Simultaneously measuring chloride and conductivity will allow for a better understanding of their relationship.

APPENDIX A

2005 Contoocook River Watershed Water Quality Data

APPENDIX B

Interpreting VRAP Water Quality Parameters